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Spatio-temporal distribution and activity pattern of Crab-eating Mongoose *Herpestes urva* (Hodgson, 1836) in and around Bardia National Park of Nepal

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Ram Chandra Kandel⁶

ABSTRACT

We used opportunistic photographic record of Crab-eating Mongoose *Herpestes urva* from camera trap set for tiger count to determine the distribution and activity pattern of Crab-eating Mongoose in Bardia National Park during 2013 and 2016/2017. A total of 257 grid cells of 2*2 sq. km were surveyed for total 3855 trap nights during winter season. The species were photographed from 17 different locations with a total of 122 photographs having 30 independent detections of Crab-eating Mongoose within an effective trapping area of 148.45 sq km. They were found nearer to the rivers flowing through the national park. *H. urva* were found active during the day time with most movements during the afternoon time. The species preferred the mixed forest and hilly terrain over other types of forests and soil surface respectively. Camera trapping survey focusing on specific species should be done extensively in Nepal in order to exaggerate the information on their distribution, ecology and threats of the species.

Keywords: Camera trap, Mixed Forest, Opportunistic survey, Tiger count, Trap nights.

1. INTRODUCTION

Mongoose is a strong and vigilant carnivore having tubular body with long pointed face, short legs, small rounded ears and a tapering bushy tail (Rayamajhi et al., 2019). Altogether, four species of Mongoose are found in Nepal; Small Indian Mongoose *Herpestes (javanicus) auropunctatus*, Indian Grey Mongoose *H. edwardsii*, Crab-eating Mongoose *H. urva* and Ruddy Mongoose *H. smithii* (Sharma and Lamichhane, 2017, Rayamajhi et al., 2019). Crab-eating Mongoose *H. urva* is characterized by a white stripe on its neck running from its cheeks to the chest (De and Chakraborty, 1995). This is a common in the mainland Southeast Asia (Duckworth, 1997; Than Zaw et al., 2008), but not in

Nepal (Thapa, 2013). The species inhabits in tropical to subtropical evergreen and moist deciduous forests (Jnawali et al., 2011). *H. urva* mostly feeds on crabs, birds, rodents, lizards, snakes (Jnawali et al., 2011), frog, crustacean, amphibians and small fishes (Chuang and Lee, 1997, Thapa, 2013). In Nepal, *H. urva* has been recorded from 100 to 1300m above sea level and is fairly common in the lowland forests (Jnawali et al., 2011, Sharma and Lamichhane, 2017).

H. urva is considered as vulnerable nationally due to its small population of approximately 1,000 individuals (Jnawali et al., 2011) which is declining due to habitat destruction, poaching for fur, unmanaged pollution and threats to its natural prey base (Jnawali et al., 2011; Thapa, 2013). The current status of the Crab-eating Mongoose within Nepal is poorly known as only a few records have been published on the species (Thapa, 2013; Rayamajhi et al., 2019). Fry (1925) was the first to document the record of the mongoose with its specific locality. Thapa (2013) published its record from eastern Sankhuwasabha District of Nepal. Similarly, the species' record from Parsa National Park was confirmed by Sharma and Lamichhane (2017). Furthermore, Rayamajhi et al., (2019) documented the camera trap evidence of the *H. urva* from the Barandabhar corridor of Chitwan.

The spatial and temporal distribution information of the species are essential for fabrication of conservation management plans (Bist et al., 2020), but the large charismatic species like Tiger *Panthera tigris* and Leopard *P. pardus* are given priority for camera trap in comparison to smaller carnivores (Sharma and Lamichhane, 2017). In Bardia National Park and its surrounding forests, camera trap surveys were carried out particularly focusing on population status of *Panthera tigris*. Despite tremendous researches and number of publications in the order carnivora (Bist et al., 2021), prioritization on small carnivores like Crab eating Mongoose is still severely lacking from lowland to the highest elevation ranges of the species. The camera trap survey, however worked to explore the status and distribution of many small mammals including Crab-eating Mongoose. This study presents the distribution and activity pattern of Crab-eating Mongoose using a systematic camera trapping approach. The study also supports the researchers and managers for future conservation activities in Bardia National Park.

2. METHODS

Study area

The study was carried out in the Bardia National Park of Nepal (968 sq.km) and its adjoining forests in south-western part (Figure 1). It is a small portion of the trans-boundary Terai Arc. 70% of Bardia National Park is covered with forests, with a balance mixture of grassland, savannah and riverine forests. The Karnali River flows through the national park providing several habitats to wildlife. The national park contains an array of eight ecosystem types such as Sal Forest, deciduous Riverine Forest, savannahs and grasslands, mixed hardwood forest, flood plain community, Bhabar and foot hills of Chure range. The area was chosen for the study as the habitat types found here are similar to the habitat of Crab-eating Mongoose.

Camera trapping survey

We used opportunistic records of Crab-eating Mongoose photographed in camera traps installed for tiger monitoring during 2013 and 2016/2017 in Bardia National Park and its adjoining forests. A total of 263 grid cells of 2*2 sq. Km were superimposed on a map of the national park. Out of 263 cells, 257 cells were surveyed successively during the dry season in 2013 (February to May) and 2016/2017 (November to February). Six grid cells were not surveyed due to inaccessibility of the terrain or lack of suitable wildlife habitat within the grid. We placed the camera traps within the same grids in both surveys. The camera trap locations within each grid cell were selected following signs of tiger. In each sampling point, a pair of motion sensor camera traps (CuddebackC1, Cuddeback Attack, Reconyx 500 and 550) were installed at 45-60 cm above ground on either side of the game trail, forest road or stream bed, maximizing the possibility of tiger capture. Camera traps were checked twice a week to observe the capture of tiger and other species. Cameras were active for minimum of 15 days in each grid cell (Karanth and Nicholas, 2002; Pokheral, 2002; Wang and MacDonald, 2009; Thapa, 2013; Lamichhane et al., 2014, Rayamajhi et al., 2019) with a sampling effort of 3855 trap nights. Camera trap photos were given unique identification names and sorted species wise in separate folders. Every photo obtained at one hour interval were considered as independent detections.

Distribution and activity pattern of Crab-eating Mongoose

The distribution of the Crab-eating Mongoose were determined based on their photographed location. Distribution map was prepared by using ArcMap 10.3 (ESRI, Redlands, CA, USA). Similarly, the activity pattern of the species was determined based on the time of the photo captured. We imported all the images from the sd card of camera traps from each stations, and collected all the date and time of species occurrence. The photos of the species in camera trap were taken into account. Finally, we used dplyr,

lubridate, and ggplot2 packages (R core team 2019) for final analysis for creating the clock chart. All other analysis were done in Ms. Excel (Microsoft Corporation, 2018).

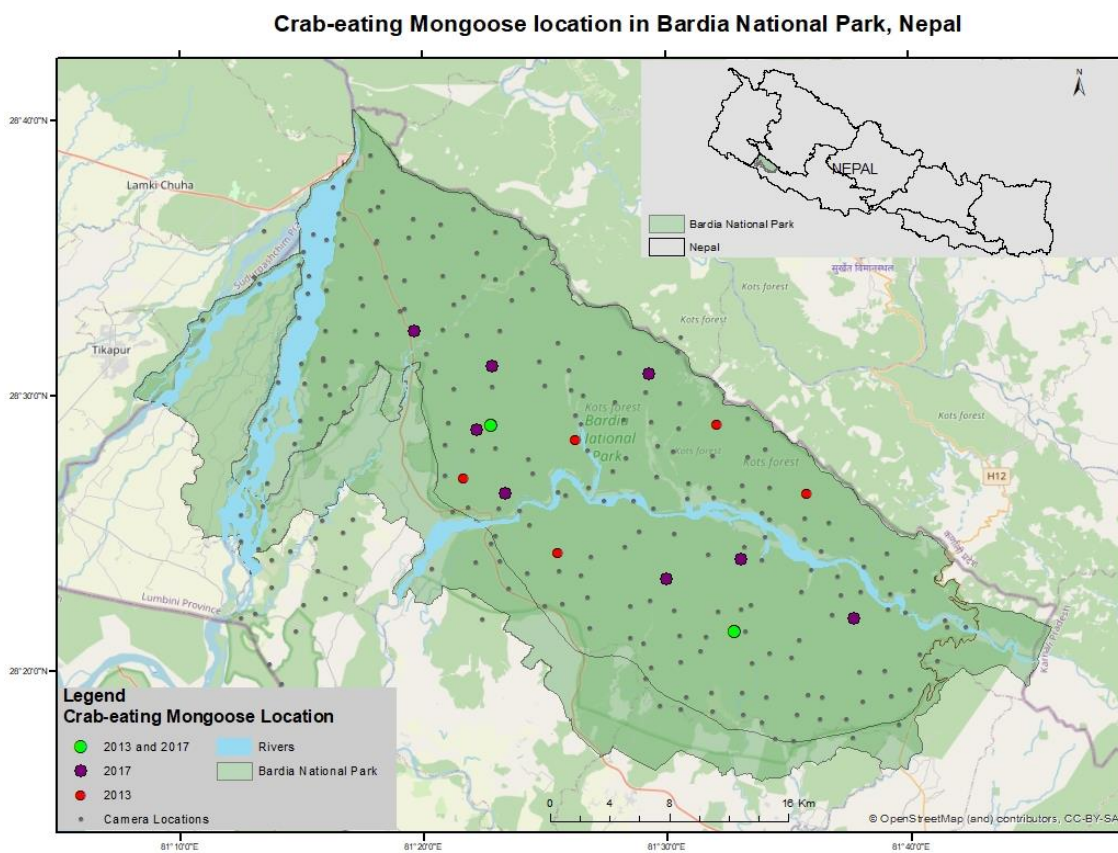


Figure 1: Crab-eating Mongoose detection location during camera trap survey in Bardia National Park (2013) (Red circles), (2017) (Pink circles) and both year 2013 and 2017 (Green circles).

3. RESULTS

Status and distribution of Crab- eating Mongoose from camera trap record

A total of 5,640 of camera-trap effort from 257 sampling locations resulted 57,871 photographs of 34 mammal species. We found 122 photographs with 30 independent detections of Crab- eating Mongoose from 17 locations in winter season during 2013 (February to May), 2016/2017 (November to February) (Figure 1). The 17 trapping stations covered an effective trapping area (ETA) of 148.45sq.km.

Habitat use by Crab- eating Mongoose

In our observation, the Crab- eating Mongoose was recorded only from the mixed forest (Figure 2). This suggest that the Crab- eating Mongoose prefer mixed habitat. Similarly, the Crab- eating Mongoose used hilly terrain (64.7%) followed by flat terrain (17.64) and so on (Figure 3).

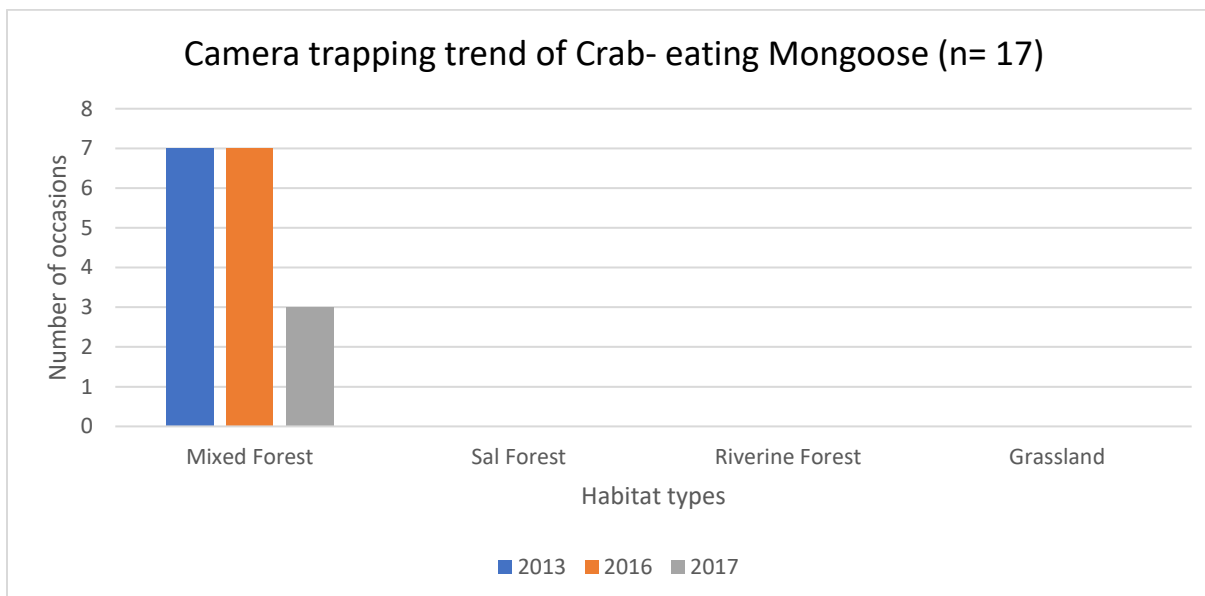


Figure 2: Camera trapping trend of Crab- eating Mongoose

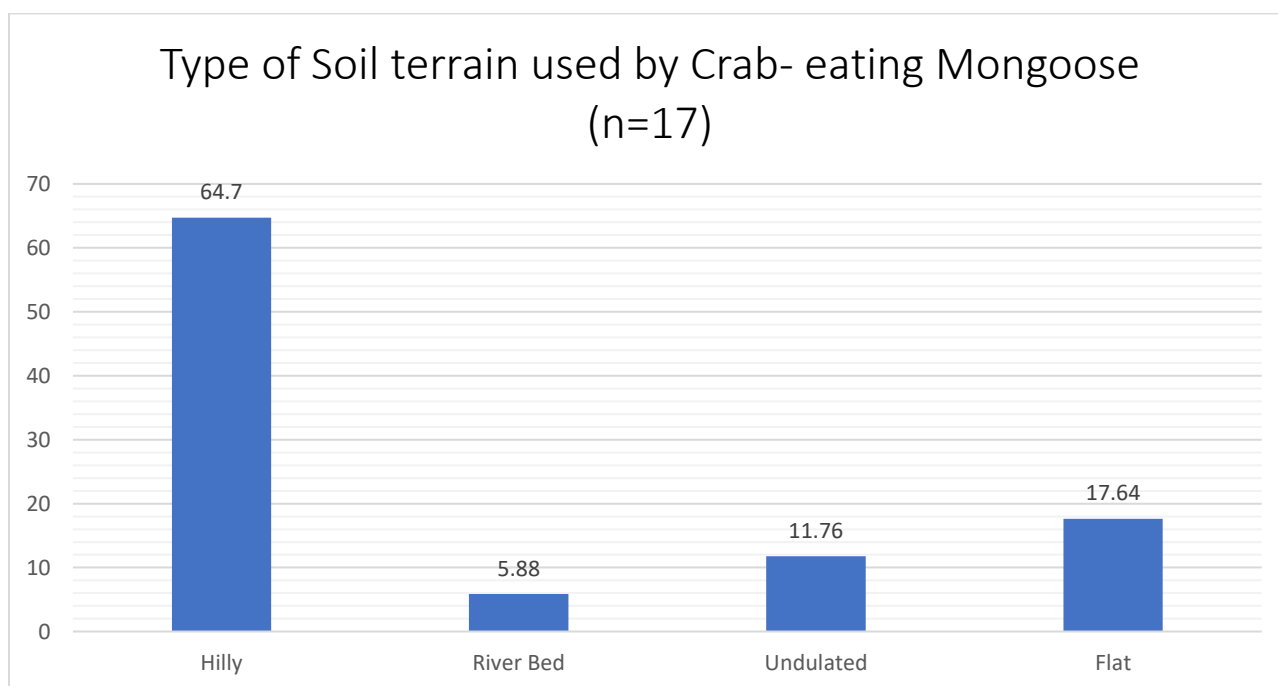


Figure 3: Type of Soil terrain used by Crab- eating Mongoose

Activity pattern of Crab- eating Mongoose

All the photos of Crab- eating Mongoose were trapped by camera during the day time (5hr to 19hr). Mostly, the Crab- eating Mongoose were active in the afternoon during 13hr to 14hr (Figure 4).

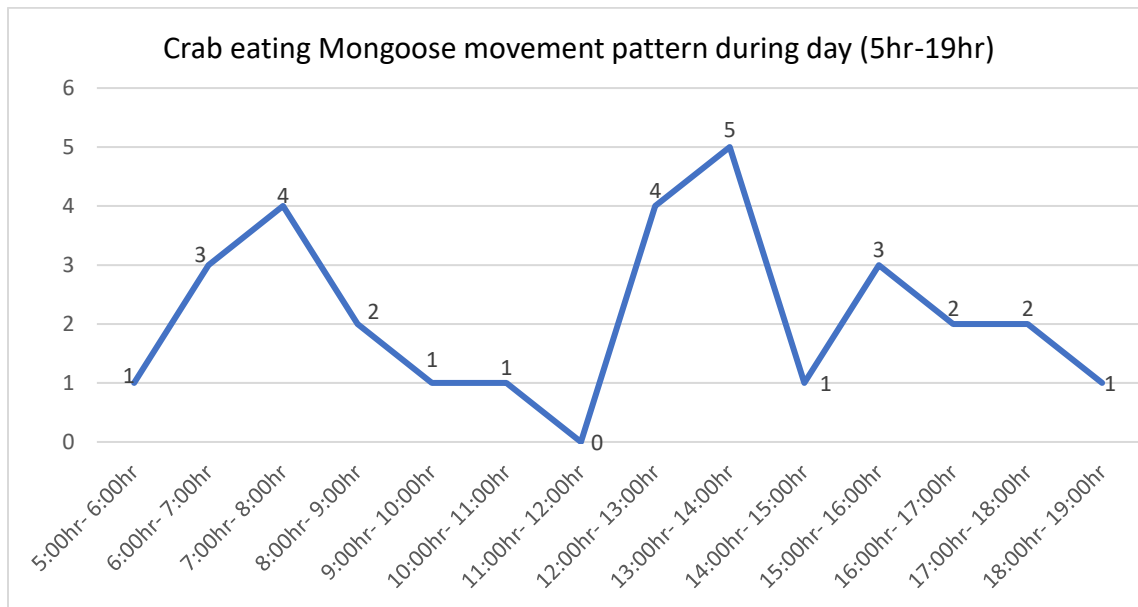


Figure 4: Crab eating Mongoose movement pattern during day

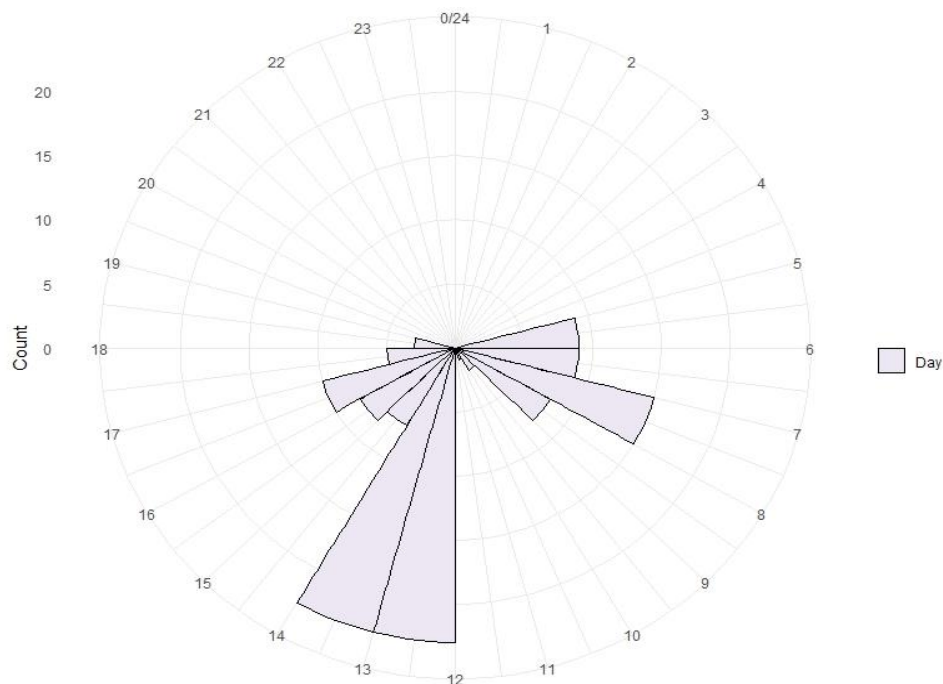


Figure 5: Clock chart showing the activity pattern of Crab-eating mongoose from the data of multiple years 2013, 2016, 2017 in Bardia district (National Park, Buffer zone and Khata corridor). The chart portrays the time period in 24 hrs

The analysis of the data for the activity pattern of the species from 2013, 2016, 2017 in different months found Crab-eating mongoose most active in day hour depicting the diurnal mode of activity pattern. It was recorded frequently with highest timely hour in between 12:00hr, 13:00hr, and 14:00hr of the day. While the species shows activity at regular interval in the early morning hours (5:00hr, 6:00hr, 7:00hr, 8:00hr) as well as in early evening hours (19:00hr, 18:00hr, 19:00hr). The result displays its movement during day hours (6:00hr to 18:00hr). The species has remained completely passive during the night hours.

4. DISCUSSION

The distribution of the Crab- eating Mongoose in the Bardia National Park were in the middle part of the national park nearer the river system flowing through it. As, the Crab- eating Mongoose mainly feed in the crabs, frogs, amphibians, crustacean and small fishes (Jnawali et. al. 2011, Chuang and Lee 1997, Thapa 2013), they might have roamed around the river system in search of their prey items. Similarly, the *H. urva* were not recorded from the location where the *Panthera tigris* were recorded as the feeding guild and habitat preference of *P. tigris* and *H. urva* are different from each other (Jnawali et al. 2011).

This record of *H. urva* was from the subtropical forest is similar to the observation of Thapa (2013) which also supports the habitat description of the species done by Jnawali et al. (2011). But its record from mixed forests contrast with the observation of Pandey and Khanal (2018), Sharma and Lamichhane (2017), and Bist et al. (2020) where they recorded the species from Sal dominated forest. As we have categorized the Sal dominated forest mixed with other trees as mixed forest and forest with only Sal as Sal Forest which might have created variation in the forest types.

H. urva preferred the hilly terrain over flat, undulating and river beds. *H. urva* were photographed during the day time only which is supported by the observation of Rayamajhi et al. (2019). So, the species can be considered as fully diurnal. Similarly, the species were photographed mostly during the afternoon time which is similar to the observation of Thapa (2013), Sharma and Lamichhane (2017) and Pandey and Khanal (2018).

5. CONCLUSION AND RECOMMENDATION

The Crab- eating Mongoose were found nearer to the water resources in the mixed subtropical forest type. The species prefer hilly terrain over other surface type and were found active during day time mainly at the afternoon followed by morning and evening. Camera trapping survey focusing on Crab- eating Mongoose should be done in other parts of Nepal too in order to exaggerate the information on their distribution, ecology and threats.

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Author's contribution

Conceptualization: SKY, BRL, MB. Data curation: SKY, MB. Formal analysis: MB, BSB, SKY. Writing original draft: MB, SKY. Review: BSB, BRL, NS, RCK.

Ethical approval

Herpestes urva (Hodgson, 1836) from Bardia National Park of Nepal was observed in the work. The Animal ethical guidelines are followed in the study for species observation & identification.

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Conflicts of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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